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Income Variation on Cash-Grain Farms (1976-1982)

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A SUMMARY OF THE INDIANA FARM ACCOUNTS

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Table of Contents

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INCOME VARIATION ON CASH-GRAIN FARMS 1976-1982

Any historical study of American Agriculture will indicate that the 1930's and 1940's are well known for improved farm practices, the 50's for the explosion of agricultural technology, the 60's for farm expansion, and the 70's for inflation. The 1980's may someday become known as the decade when financial management became very important. Renewed emphasis is now being placed on financial statements, both net worth and income, on farm planning, budgeting, enterprise analyses, cash-flow spread sheets, and on such issues as whether another mortgage or an additional operating loan is a prudent alternative.

Decisions regarding an additional investment, whether in land or in farm machinery, are increasingly difficult. Determining whether a given investment is economically feasible requires considerable time, trouble, and effort. Fewer of these decisions can be based on some scribbles on the back of an envelope; more of them now require a comprehensive analysis, often with the aid of a computer.

The kinds of analyses needed depend in part on the trends in the past and on the relationships that exist between various major farm business factors and the incomes obtained on cash-grain farms by the farm families cooperating in the Indiana Farm Account Project. There is a surprisingly large farm-to-farm variation in the incomes obtained on these farms. In some instances, there appears to be little or no reason for the differences; in other instances, that variation can be explained fairly easily.

Traditionally, the project has classified all farms according to farm size, whether small, medium, or large. The incomes for the high- and low-profit groups within each of these categories are presented in Tables 1 and 2. This study has sorted all cash-grain farms into several additional categories, using farm size, crop yields per acre, and other measures of efficiency as major factors affecting incomes. The objectives were to determine the existing relationships between each of the major factors and the dollar returns to the farm family, to ascertain the extent to which these factors continue to influence the incomes obtained on cash-grain farms, and to see if these effects occur year after year.

Methods of Analysis

Tabular analyses and regression techniques have both been used to examine the relationships between farm size and labor incomes, between crop yields and labor incomes, and also several joint relationships that combine the effects of these same variables.

In developing these relationships all farms were first arrayed according to an independent variable or sort factor from the lowest to the highest observations, and then sorted or divided (and continuously resorted and redivided) into five equal groups. Each group of farms has within it a nearly equal if not equal number of observations. Each group thus represents 20 percent of all cash-grain farms, for example, the top 20 percent, the above-average 20 percent, the middle 20 percent, etc, and each has been given a label, in the case of farm size, for instance, small, below-average, average, above-average, and large farms.

This technique allows one to study the variation in the independent variables or sort factors of size, yields, and efficiency as well as the extent to which some other variable, the dependent one, is related to it.[1] In each instance, the objective is to ascertain the relationship between the independent variable (size, yields, rates, etc.) and the dollar returns to the farm family (labor income).

In several instances multiple regression techniques were used to hold constant one variable (X1) and study the effect of a second variable (X2) on incomes (Y). This somewhat more sophisticated technique provided a series of correlation coefficients indicating that "x" percent of the variation in the income is explained by these factors.

Each independent variable or sort factor varies considerably in terms of its effect on or ability to explain the variations in income. The data for 1982 have been presented in tabular fashion, and the results for the six previous years have been presented in separate tables. This shows the extent to which a given relationship varies from one year to the next and allows the reader to study the trends and make his own judgments.

Also included are several price charts showing the more recent changes in the general price level, the relationship between farm prices received and farm costs, and several individual farm commodity prices.

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1 The traditional sort into high- and low-profit farms, which is done by most farm account projects, is a backward sort. Statistically it is unconventional in that it ignores any typically expected cause-and-effect relationship. The sort factor used in each of the tables which were developed in this study is the independent variable. The level of income is presumed to be dependent upon these sort factors.

One further needs to recognize, of course, that a high mathematical relationship or correlation coefficient does not necessarily mean that there also exists a cause-and-effect relationship. The number of drunks who enjoy their weekends in Edinburgh and the number of brides who are married during those same weekends in London may be highly correlated, but that does not mean that one caused the other. Establishing cause and effect is not a function of mathematics but rather is a result of judgment and experience. Thus the conclusions presented in this publication are based on the author's evaluation of the data.

Variation in Incomes, 1976-1982

The traditional classification relative to small medium and large farms and lowversus high-profit farms is presented in Table 1. The medium sized farms, those ranging from 361 to 664 tillable acres, had an extremely wide variation in incomes in 1982. The average labor income ranged from $-24,301 on the low-profit farms to $+62,092 on the high-profit farms. These farms were quite comparable in terms of the number of acres being farmed, the amount of labor that was available, and the amounts of capital invested.

Table 1. Land, Labor, and Capital Resources Related to the Variation in Labor Incomes. 141 Farms, Indiana Farm Account Project, 1982.

Size of Farm	Small		Medium		Large	
Tillable Acres	360 or Less		361 to 664		665 or More	
Income Grouping	Low	High	Low	High	Low	High
Number of Farms	23	24	23	24	23	24
Total farm acres	290	320	605	596	1,209	1,478
Acres of cropland	241	261	513	520	1,059	1,389
Land value per acre	$1,554	$1,459	$1,584	$1,546	$1,560	$1,795
Months of labor	23.9	21.6	27.1	24.0	35.8	45.8
Total days prod. work	517	551	598	612	891	1,571
Days prod. work per man	260	306	265	310	299	411
Capital investment--dollars						
Land, blgs, improvements	$450,561	$466,172	$958,250	$921,343	$1,886,019	$2,653,023
Livestock	92,586	70,133	88,819	69,904	108,099	161,985
Machinery and equipment	48,952	50,514	81,212	72,198	168,667	163,449
Feed, grain, supplies	42,582	42,031	83,464	103,722	162,396	331,863
Total investment	$634,691	$628,850	$1,211,745	$1,167,158	$2,325,181	$3,310,320
Capital investment per man	$318,644	$348,857	$ 537,218	$ 584,207	$ 780,074	$ 866,860
Labor income	$-25,696	$+32,174	$ -24,301	$ +62,092	$ -18,834	$+204,983
Return on capital	-2.4	+6.2	+0.5	+7.1	+2.0	+8.6

Source: Indiana Farm Account Summaries, 1982.

Similar results, wide variations in income, are seen with both the smaller and the larger farms. The number one factor influencing these variations in income was management, the ability or inability of the farm family to organize the various land, labor, and capital resources, combine them in proper fashion, and get each job done on time.

The same variation in incomes is seen year after year (Table 2). The ten-year average income for each of the above-mentioned groups has been summarized into the following figures.

	Low Profit Farms	High Profit Farms
Small farms	$ -11,040	$ +34,445
Medium size farms	-13,514	+57,299
Large farms	$ -18,510	$+131,975

Table 2. The Variation in Incomes all Small, Medium, and Large Farms, and for Low- and High-Profit Farms. Indiana Farm Accounts, 1973-1982.

Farm Size...	Small		Medium		Large	
Income...	Low	High	Low	High	Low	High
1982	$-25,696	$ 32,174	$-24,301	$ 62,092	$ -18,834	$ 204,983
1981	-40,099	10,418	-61,844	3,899	-112,933	54,388
1980	-19,339	37,931	-23,284	68,871	-23,814	146,917
1979	-9,623	62,381	-13,321	73,656	-34,278	136,917
1978	698	42,547	1,861	76,937	-19,184	123,371
1977	-5,957	21,790	-27,555	35,927	-48,860	58,728
1976	-7,878	35,815	1,442	64,821	2,301	126,509
1975	-6,385	32,854	-3,770	57,344	11,981	156,955
1974	-7,225	27,072	-13,823	45,645	-8,482	118,786
1973	$ 11,105	$ 41,465	$ 29,460	$ 83,796	$ 67,003	$ 192,199
Average	$-11,040	+34,445	-13,514	+57,299	-18,510	131,975

Assuming a reasonable amount of capable management, which may or may not be justified, one can easily hypothesize that there are differences in the farm prices received by farmers as well as differences in farm size, crop yields per acre, and differences in efficiency, for example, the ability or inability to get each job done on time.

The following tables have been designed to show if the income variations in the 1976-1982 period were related to each of the major factors that presumably affect farm incomes as well as the degree or strength of the relationships.

Farm Prices

Prices have traditionally had a major influence on the farm incomes of farmers. Unfortunately, the variation in the price of any one farm product is the result of many interrelated price movements, often making any one individual price-making force difficult to identify.

In farm management one needs to study 1) changes in the general price level, 2) the relationship between farm prices received and paid (farm costs), 3) the relationships between various individual farm product prices and/or farm costs, 4) cyclical price changes, 5) seasonal price variation, as well as other contributing factors.

The farmer generally has not had much control over the prices he receives or pays. (There are notable exceptions.) Yet, various price changes are closely associated with both farm income and with some of the more difficult farm decisions, when to get started in farming, when to adopt some new technology and change the farm's organization, when to expand a given farm enterprise, and/or when to buy land. Every successful farmer continuously studies the general price level along with the variation in corn and soybean prices.

General Price Level The general price level is the oldest price series in the United States. It consists of an index of over 1,000 wholesale commodities, both farm and non-farm, with each commodity weighted according to its relative importance in the national economy (Figure 1).[2] Its purpose is to measure the overall change in all prices in the economy.

Historically, the index has fluctuated violently. During the first half of this century sizable ups and downs generally occurred during and after each major war. However, during and since the Korean war and the Vietnam conflict, the federal government has attempted to produce military hardware and provide social services simultaneously. Starting in 1973 this has been a primary factor leading to the most severe price inflation in the economic history of this country. In the last 10 years the value (and cost) of practically everything has increased.

Those persons or businesses having to make long-term investments are those most affected by changes in the general level of all prices. Farmers and others who purchased land in the last two or three decades, from 1945 through 1975, whether to expand their farm businesses, as a hedge against inflation, or both, enjoyed reading their financial statements. The increases in net worth due to increased farm land values were quite satisfying.

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3 The term "wholesale" has recently been changed to the word "producer"; however, the purpose remains the same.

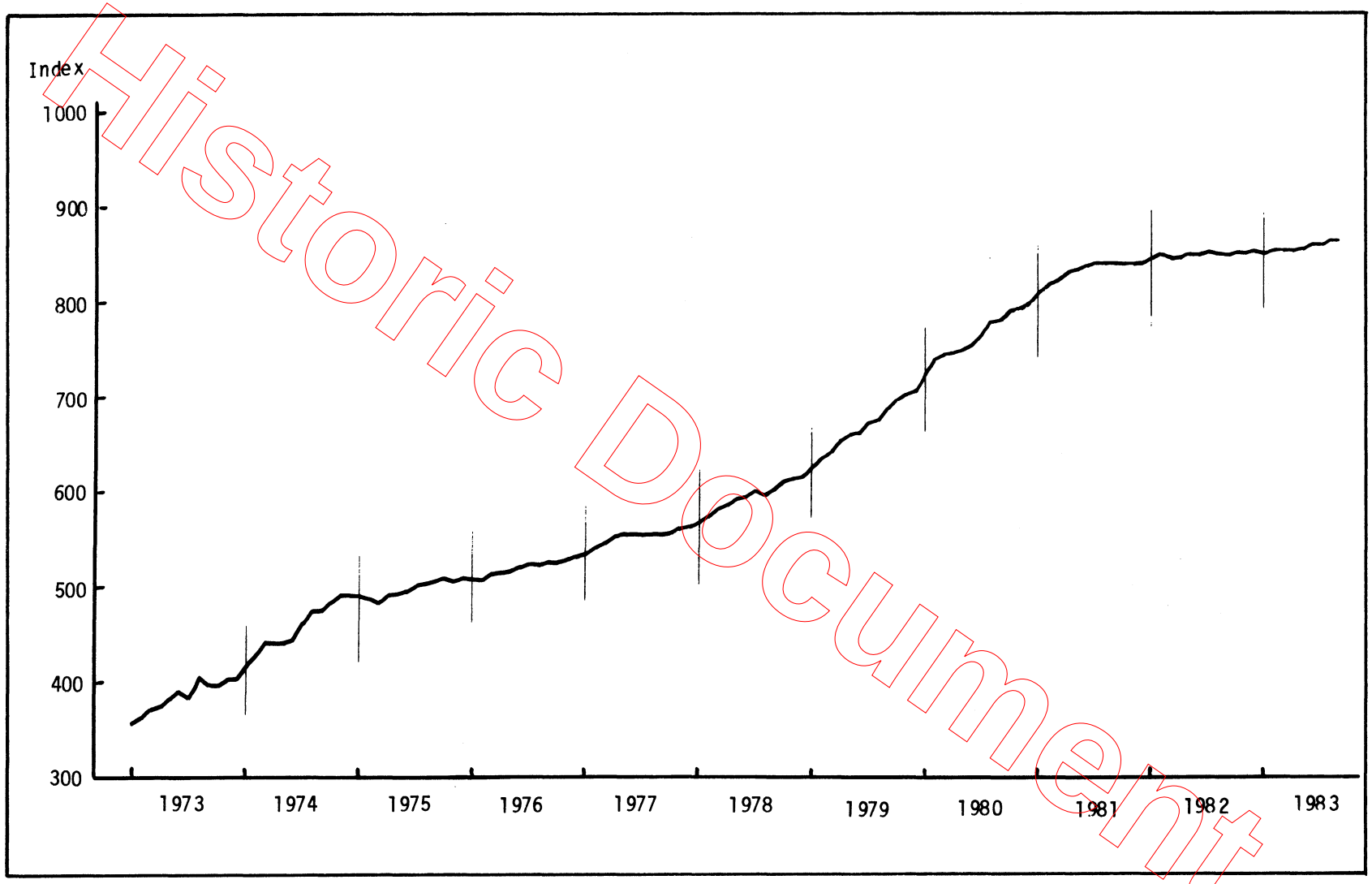

Figure 1. THE GENERAL PRICE LEVEL, 1973-1983.

Those who adopted the equity-leverage philosophy early in the game have been fantastically successful, financially. But those who borrowed lots of money a little later in the game, only to then encounter variable rates of interest, experienced some very serious financial problems.

The last chapter on farm land values has not been written. There are both farm families in bankruptcy today and farm families who are prepaying some of their principal payments, avoiding the high interest costs. Whatever the scenario, the general price level has affected farmers all their lives. Unfortunately, many of them are not aware of the impact on their income until it is too late to make adjustments in their business.

Farm Prices Received vs Farm Costs When the general level of all prices is rising, the prices received by farmers have had a tendency to go up faster and further than the prices of those articles that farmers have to buy (Figure 2). Farm costs or prices paid tend to lag behind. When this is so, farm incomes increase rapidly. This kind of a period is always a very favorable time to get started in farming, to adopt a new technology, to change to a different farm organization, or to buy land.

From 1973 through 1975 the index of Indiana farm prices and the index of U. S. farm costs were practically the same. However, beginning in 1976 they parted, with farm costs rising faster than prices received. Starting in 1979 the index of farm costs rose fairly rapidly, while the prices received by Indiana farmers remained behind. Thus, any long-term investment in agriculture had to be made from a very solid financial foundation and/or with the idea that superior management could compensate for any economic adversity that might come along.

Individual Farm Product Prices Every farmer should be aware of and continuously study the changes that constantly occur in the price of whatever individual farm product he is producing as well as the broad farm price and farm cost indices. There are many examples, the prices received for corn and soybeans being the predominant ones on cash-grain farms. They have had a real impact on the incomes received by cash-grain farmers.

Corn: The price of corn has experienced some fairly sizable fluctuations from year to year, but the over-all trend during the last 10 years has, for all practical purposes, been level (Figure 3).

Soybeans: The price of soybeans has been at a higher level. But it also has expeienced some fairly sizable fluctuations, going over $9.00 per bushel at least twice in the ten years.

The price changes for both of these crops tend to be erratic, dependent upon the size of the crop, the amount of carryover from the previous year, and the demand for corn, soybeans, and other grain in the international markets.

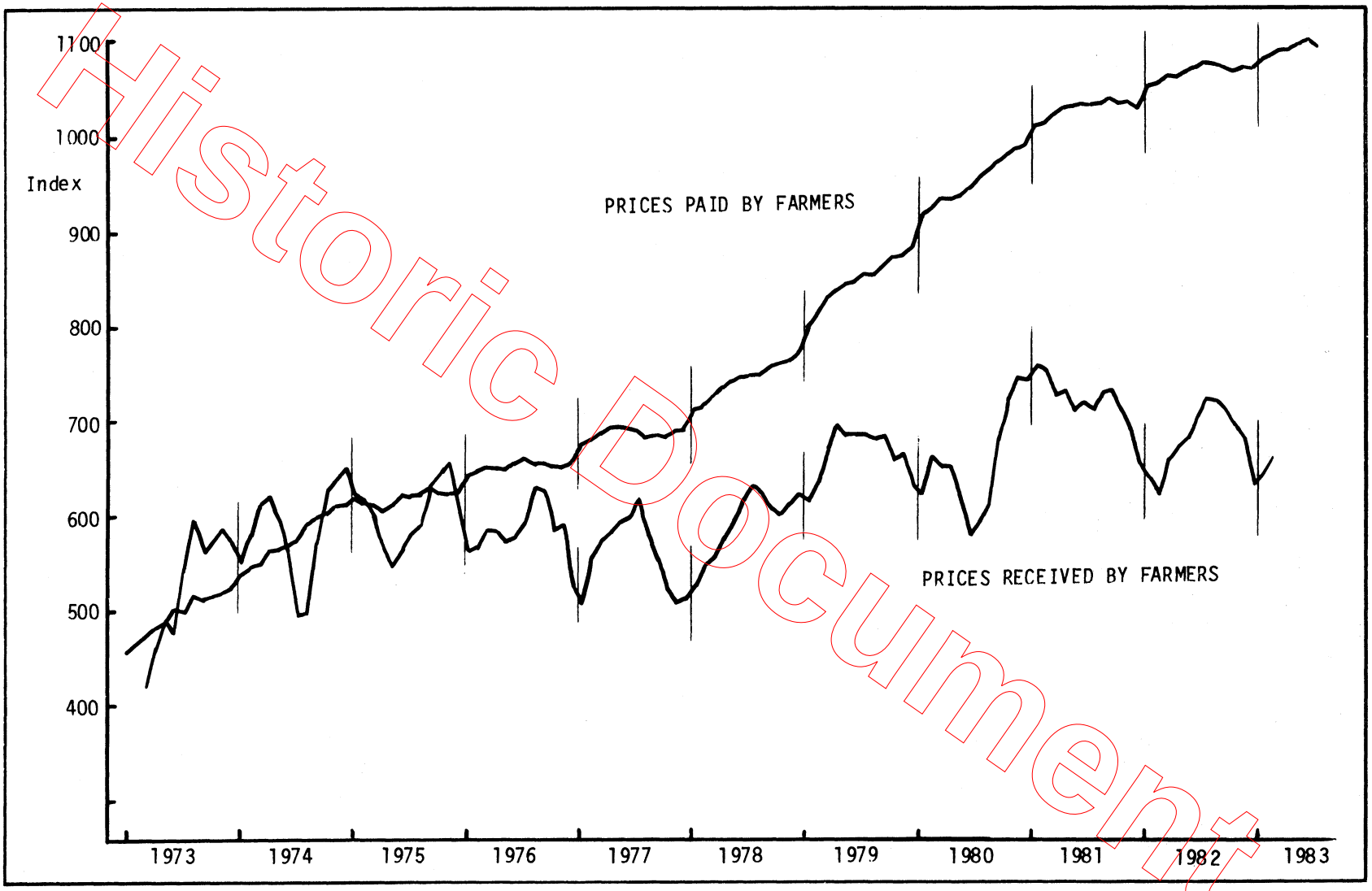

Figure 2. INDICES OF FARM PRICES RECEIVED BY FARMERS IN INDIANA AND PRICES PAID BY FARMERS IN THE UNITED STATES, 1973-1983.

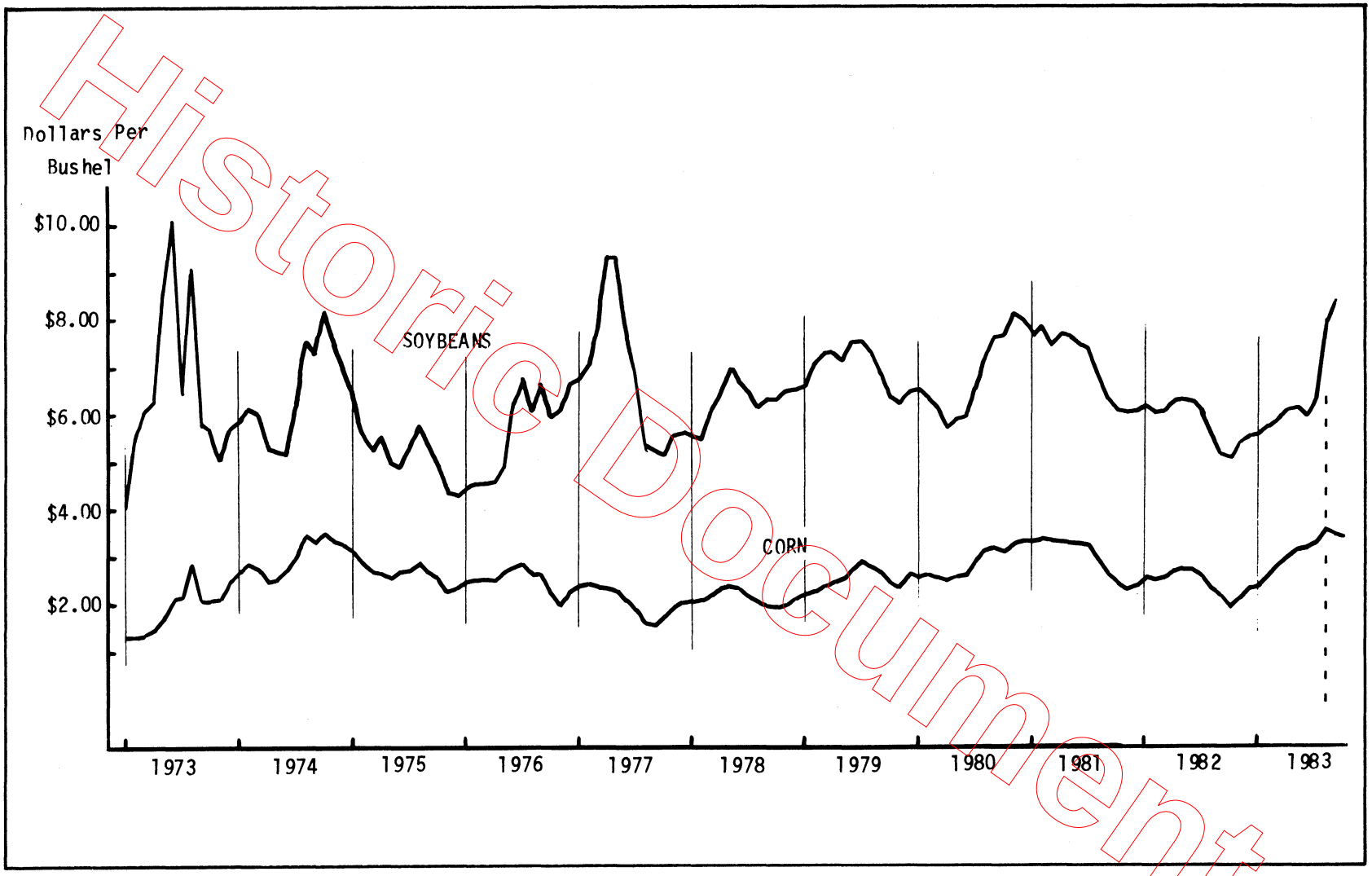

Figure 3. FARM PRICES RECEIVED BY INDIANA FARMERS, 1973-1983.

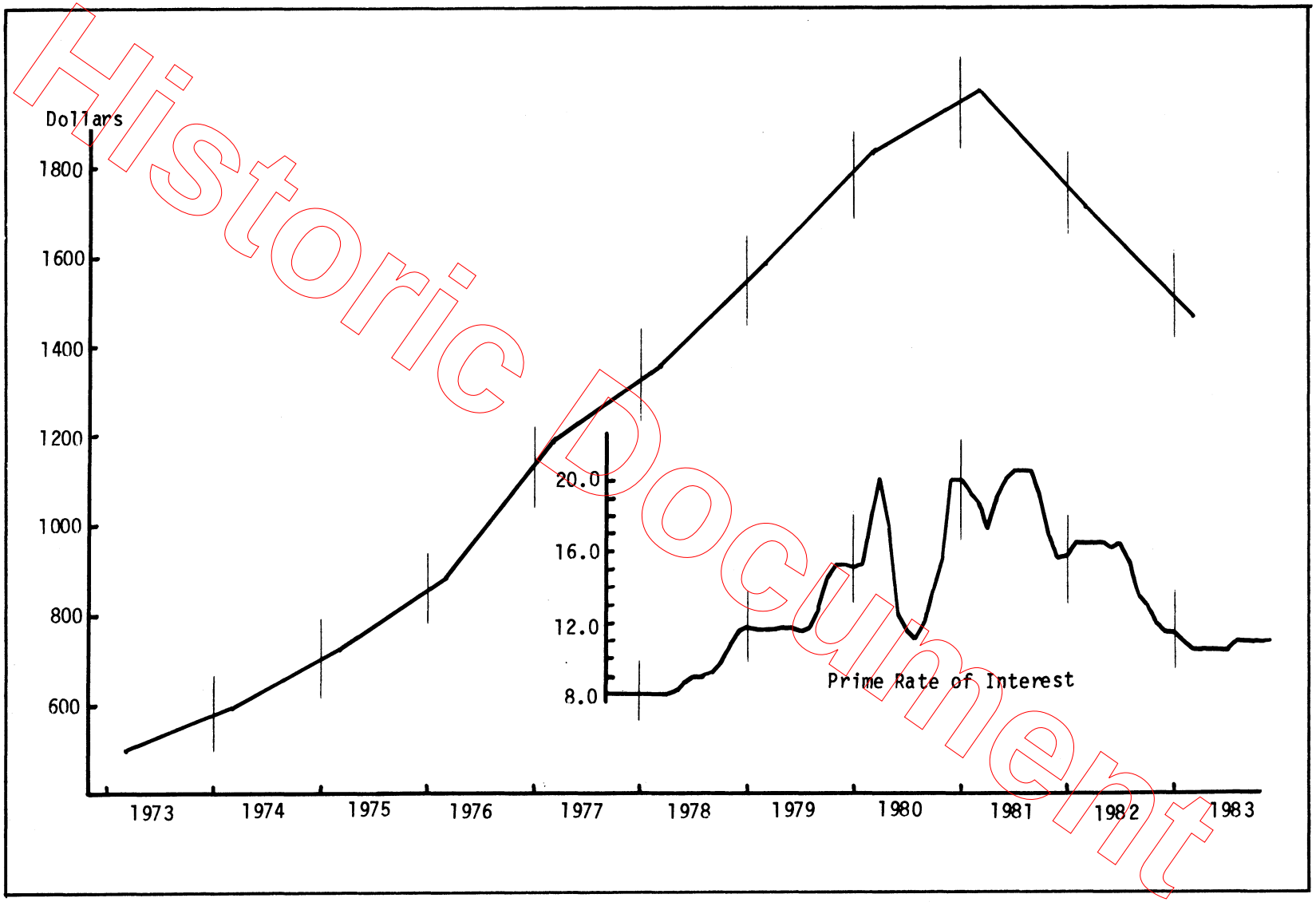

Figure 4. INDEX OF FARM REAL ESTATE VALUES, INDIANA, 1973-1983 AND THE PRIME RATE OF INTEREST, 1987-1983.

These price charts show that we have come through a period in which we have experienced a sizable amount of inflation in the economy as a whole. But that inflation has not been shared by farmers. The index of Indiana farm prices, along with the prices of corn, and soybeans, contains some wild variations, yet over a period of time the trend has remained constant. Meanwhile, the index of prices paid by farmers or farm costs has continued to rise much faster than the index of farm prices received. This kind of a price-cost scenario is not one which leads to favorable farm incomes.

Relationships Between Corn and Bean Prices and Incomes The farm prices received for corn and soybeans are of major importance to the cash-grain farmer. When price chages occur with either of these crops, incomes have a tendency to go up or down rather rapidly (Table 3). The most dramatic example was when the price of soybeans went from $3.30 per bushel in 1972 to $6.53 in 1973. The average labor income on the cash grain farms increased from $18,353 to $99,475.

Table 3. Relationship Between Corn and Soybean Prices and Labor Incomes.
Indiana Farm Account Cooperators, 1968-1982.

Year	Indiana Farm Price		Bean-Corn Price Ratio	Labor Incomes*		
	Corn	Soybeans		All Cash Grain Farms	All Farms Indiana	All Large Farms
1968	$0.99	$2.47	2.49	$ 3,874	$ 7,935	$ 9,548
1969	1.11	2.41	2.17	25,355	23,779	40,791
1970	1.25	2.60	2.08	13,015	9,185	14,982
1971	1.27	2.94	2.31	13,070	10,374	18,273
1972	1.15	3.30	2.87	18,353	32,905	58,126
1973	1.93	6.53	3.38	99,475	74,872	140,868
1974	2.97	6.46	2.17	55,198	28,631	57,826
1975	2.59	5.24	2.02	41,123	38,736	79,541
1976	2.38	5.61	2.36	53,639	38,345	65,977
1977	2.01	6.77	3.37	4,930	7,519	7,423
1978	2.04	6.27	3.07	18,917	36,952	50,068
1979	2.39	6.95	2.91	37,209	36,191	52,313
1980	2.82	6.82	2.42	36,389	34,761	66,371
1981	2.96	7.02	2.37	-36,421	-28,053	-37,507
1982	$2.40	$5.81	2.42	$18,222	$ 30,000	$ 71,328
Fifteen-year average			2.56	$ 26,823	$ 25,542	46,395

Sources: Indiana Crop and Livestock Statistics, Historical Summary and Annual Summaries through 1982. Agricultural Prices. 1980, 1981, and 1982. Indiana Farm Business Summaries, Department of Agricultural Economics, Purdue University.

The price changes for 1978-1979 are of particular interest in that the price of corn increased 17 percent and the price of soybeans 11 percent. Incomes on the cash grain farms doubled.

The longer-term price movements can sometimes have considerable impact on farm organization. It is for this reason that the ratio between soybean and corn prices is presented. It has taken a total of 2.56 bushels of corn to equal 1.0 bushel of soybeans over the more recent 15-year period.

The price relationships in Table 3 are not perfect. First, the prices presented are 12-month averages. They do not fully recognize the exact moments of a price change. These changes do not conveniently occur at the beginning or end of any one calendar year. Second, farmers do not always keep perfect records of their inventories. Most are on a cash rather than accrual basis for purposes of reporting of taxable incomes. Also it typically pays to delay sales into a later year anytime this is possible.

Size of Farm

Most farmers have found their competitive positions to be greatly enhanced during the past couple of decades by increasing the size of their farm or the volume of their business. In many instances this has been through the purchase of more acres, which has required the addition of increasingly large amounts of capital. Whatever the case, size or volume is a very significant factor affecting profits in farming.

There are many means by which size of farm or volume of business may be measured.

1. Total farm acres.
2. Acres of cropland (tillable acres).
3. Acres of an individual crop.
4. Numbers of a particular kind of livestock.
5. Number of men (man equivalent).
6. Total productive man work units.[3]
7. Total farm capital.

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* Labor income is defined as the dollar return to the farm operator after paying all farm operating expenses and a 5.0 percent interest charge on all farm capital--both equity and borrowed.

3 A productive man work unit is the amount of work done by one man in a ten-hour day under average conditions. Total man work units are calculated by multiplying the acres of each crop and the numbers of each kind of livestock by certain specified units, based on the average amount of time required to handle one acre or one animal. Total productive man work units thus represent the total number of days of labor that are required, under average conditions, to raise the acreage of crops grown and to care for the numbers of livestock kept.

Trends in Farm Size Farms increased in size in the 1976-1982 period (Table 4). In terms of total farm acres, the average farm added an average of 47 acres per year; the large farms added an average of 127 acres per year. In terms of acres of cropland, the average farm added an average of 49 acres per year; the large farms added an average of 137 acres of cropland per year. In terms of the other factors which may be used to measure size of farm or volume the average increases each year are as follows.

	Average Annual Increase	
	Average Farms	Large Farms
Total farm acres	+47	+127
Acres of cropland	+49	+137
Number of men	+.04	+.17
Total farm capital	$+188,167	$+722,333

Table 4. Trends in The Size of All Cash-Grain Farms. Indiana Farm Accounts, 1976-1982.

Level of Farm Size	Year						
	1976	1977	1978	1979	1980	1981	1982
	...Total Farm Acres...						
Small Farms	332	315	145	439	372	430	448
Below Average	537	447	601	566	563	571	597
Average	612	579	770	845	755	740	779
Above Average	745	848	1,042	1,013	1,062	949	1,062
Large Farms	1,185	1,587	1,725	1,650	1,752	1,716	1,947
All farms	685	750	911	897	904	879	967
	...Acres of Cropland...						
Small Farms	294	283	399	400	350	396	414
Below Average	481	407	542	536	511	527	543
Average	535	509	681	741	665	675	694
Above Average	662	798	946	947	948	882	990
Large Farms	1,025	1,471	1,645	1,548	1,609	1,642	1,847
All farms	602	689	837	829	820	822	897
	...Number of Men Per Farm...						
Small Farms	1.04	1.06	1.13	1.05	1.06	1.04	1.01
Below Average	1.23	1.22	1.35	1.29	1.29	1.28	1.28
Average	1.45	1.54	1.76	1.67	1.50	1.56	1.53
Above Average	1.81	1.96	2.33	2.26	2.21	2.14	1.96
Large Farms	2.53	2.91	3.63	3.59	3.60	3.70	3.55
All farms	1.62	1.73	2.03	1.96	1.95	1.94	1.87

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Table 4. Trends in The Size of Farms, cont.

Level of Farm Size	Year						
	1976	1977	1978	1979	1980	1981	1982
	Total Productive Man Work Units...						
Small Farms	238	229	230	209	206	216	207
Below Average	306	265	318	313	284	283	276
Average	419	364	404	387	375	373	357
Above Average	532	523	583	498	509	508	498
Large Farms	785	927	814	880	973	962	958
All farms	457	459	469	455	472	467	459
	...Total Farm Capital ($1,000)...						
Small Farms	$ 341	$ 374	$ 600	$ 686	$ 716	$ 759	$ 807
Below Average	557	537	947	1,033	1,097	1,094	1,097
Average	767	787	1,204	1,589	1,578	1,645	1,575
Above Average	903	1,103	2,010	2,236	2,242	2,250	2,217
Large Farms	1,737	3,085	3,669	3,973	3,946	4,161	4,271
All farms	$ 864	$1,166	$1,675	$1,889	1,924	1,977	1,993

Relationships Between Farm Size and Incomes, 1982 When size of farm or volume of business increases, farm incomes have a tendency to do the same. But all other factors, such as prices and efficiency, need to be favorable; otherwise they can affect, and sometimes upset, the expected relationships. The traditional size-to-income relationship is particularly affected by the prices received for corn and soybeans.

In 1982 the large farms had incomes far above the averages for any of the four smaller groups (Table 5). There was no one best over-all relationship. But regardless of the measure of size, the top 20 percent of all farms had incomes far and above the averages for each of the smaller groups.

Table 5. Relationships Between Size of Farm And Labor Income. 65 Farms, Indiana Farm Account Project, 1982.

Total Farm Acres Range	Total Farm Acres Average	Number of Farms	Acres of Cropland	Percent in Corn	Corn Yield	Percent in Soybeans	Soybean Yield	Labor Income
366 - 507	448	13	418	55	137	33	42	$ 2,101
524 - 652	597	13	556	51	130	35	43	5,986
652 - 911	779	13	699	50	139	42	44	-12,277
917 -1271	1062	13	968	48	137	41	44	3,452
1475 -3225	1947	13	1847	55	146	39	45	$97,623
All farms	967	65	897	52	138	38	44	$19,377

Acres of Cropland Range	Acres of Cropland Average	Number of Farms	Percent in Corn	Percent in Soybeans	Yield Per Acre Corn	Yield Per Acre Soybeans	Land Value Per Acre	Labor Income
349 - 466	414	13	55	32	136	42	$ 1,635	$-2,381
486 - 585	543	13	51	39	141	44	1,518	9,117
612 - 790	694	13	48	40	132	44	1,877	-4,910
875 -1,256	990	13	51	39	136	43	1,706	-2,563
1,300 -3,225	1,847	13	55	39	146	45	$ 1,810	$97,623
All farms	897	65	52	38	138	44	$ 1,709	$19,377

Man Equivalent Range	Man Equivalent Average	Number of Farms	Total Farm Acres	Total Farm Capital	Work Units Per Man	Labor Income
0.9 - 1.1	1.01	13	551	$ 996,969	256	$ 1,786
1.2 - 1.4	1.28	13	735	1,426,705	234	2,965
1.4 - 1.6	1.53	13	746	1,448,456	216	-5,686
1.6 - 2.5	1.96	13	978	2,056,773	247	3,678
2.6 - 5.9	3.55	13	1,823	4,037,863	255	94,142
All farms	1.87	65	967	$ 1,993,353	242	$19,377

Total Man Work Units Range	Total Man Work Units Average	Number of Farms	Acres of Cropland	Corn Yields	Man Equivalent	Work Units Per Man	Labor Income
176 - 230	207	13	486	140	1.12	187	$-5,397
244 - 320	276	13	606	141	1.42	201	9,071
320 - 393	357	13	793	131	1.52	249	541
398 - 632	498	13	1024	130	1.83	288	-8,332
648 - 1582	958	13	1925	148	3.45	283	101,002
All farms	459	65	897	138	1.87	242	$19,377

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Table 5. Relationships Between Size and Income, cont.

Total Farm Capital ($1,000) Range	Average	Number of Farms	Acres of Cropland	Number of Men	Work Units Per Man	Labor Income
$ 526 to $ 942	$ 807	13	430	1.17	216	$ 584
965 to 1,304	1,907	13	545	1.41	199	6,869
1,326 to 1,865	1,575	13	717	1.58	234	-4,966
1,906 to 2,573	2,217	13	978	1.69	295	-7,313
$2,813 to $9,199	$4,271	13	1,817	3.48	264	101,911
All farms	$1,993	65	897	1.87	242	$19,377

Previous Year Comparisons A third set of tables shows the dollar results achieved by the increase in farm size in 1982 along with the "same" results achieved in the six previous years (Table 6).

Table 6. Relationships Between Size of Farm And Labor Incomes. Indiana Farm Accounts, 1976-1982.

Level of Farm Size	Labor Income Year 1976	1977	1978	1979	1980	1981	1982
			...Total Farm Acres...				
Small Farms	$31,831	$ 5,813	$34,216	$14,768	$20,100	$-28,768	$ 2,101
Below Average	38,226	28,751	38,442	27,426	31,484	-20,369	5,966
Average	17,572	1,350	18,563	28,747	20,254	-30,654	-12,277
Above Average	20,643	10,549	13,229	41,246	55,546	-21,362	3,452
Large Farms	23,557	-33,920	16,230	126,401	79,731	-50,971	$97,623
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377
			...Acres of Cropland...				
Small Farms	$36,538	$ 5,200	$34,216	$ 9,406	$14,607	$-31,742	$-2,381
Below Average	33,812	26,656	37,737	32,118	24,351	-26,427	9,117
Average	34,704	1,574	22,229	24,725	15,108	-27,843	-4,910
Above Average	5,720	13,001	10,727	44,765	65,976	-22,840	-2,563
Large Farms	23,911	-33,920	16,230	126,401	87,348	-43,474	$97,623
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377
			...Number of Men (Man Equivalent)...				
Small Farms	$46,142	$11,025	$25,139	$40,422	$16,281	$-29,961	$ 1,786
Below Average	9,802	10,465	22,482	25,464	30,318	-2,672	2,965
Average	13,804	5,488	9,728	19,579	36,728	-43,382	-5,686
Above Average	13,195	18,806	48,604	26,144	47,948	-36,933	3,678
Large Farms	48,258	-33,833	11,955	129,418	75,110	-38,268	$94,142
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377

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Table 6. Relationships Between Size of Farm And Incomes, cont.

Level of Farm Size	Labor Income Year 1976	1977	1978	1979	1980	1981	1982
	...Total Productive Man Work Units...						
Small Farms	$41,661	$ 8,895	$19,753	$37,557	$27,807	$-25,625	$ -5,397
Below Average	45,061	31,362	9,126	7,459	19,908	-24,989	9,071
Average	-698	11,602	30,817	36,345	48,648	-37,610	541
Above Average	21,922	-6,948	10,952	39,134	26,750	-14,364	-8,332
Large Farms	20,839	-33,833	54,546	121,248	80,638	-49,041	101,002
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377
	...Total Farm Capital...						
Small Farms	$37,333	$ 8,273	$26,988	$23,335	$27,155	$-31,934	$ 584
Below Average	33,333	19,766	40,059	42,324	30,944	-8,594	6,869
Average	29,225	7,969	48,198	30,789	33,340	-21,268	-4,966
Above Average	20,105	7,292	-9,822	20,163	51,963	-47,031	-7,313
Large Farms	13,775	-31,703	18,321	122,862	63,368	-43,968	101,911
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377

With two exceptions, the larger farms had incomes 121 percent above the average. However, the percentage figure varied with the measure of farm size.

	Incomes Per Farm		Percent of
	Average Farms	Large Farms	Average
Total farm acres	$31,724	$68,708	217
Acres of cropland	31,724	70,303	222
Number of men	31,724	71,777	226
Total man work units	31,724	75,677	238
Total farm capital	31,724	64,007	202
All measures	$31,724	$70,094	221

The years 1978 and 1981 were exceptions. They illustrate the well known reversal that occasionally occurs when farm prices and/or farm costs become unfavorable. Large farms have the opportunity to make large amounts of money, but they also run the risk of encountering large dollar losses.

In 1978 and 1981 the larger farms lost more money than did the average farms.

	Losses Per Farm	
	Average Farms	Large Farms
Total farm acres	$-13,976	$-42,445
Acres of cropland	-13,976	-38,697
Number of men	-13,976	-36,050
Total man work units	-13,976	-41,437
Total farm capital	$-13,976	$-37,835

These losses are sizable compared to the average for all farms. Yet, they are not particularly sizable when compared to the average incomes on these same farms, in 1976, 1977-1980, and 1982. The year 1981 was preceeded by 3 years of fairly high incomes; the year 1977 was preceeded by 8 years of satisfactory incomes. Thus one can hypothesize that for each year with a dollar loss there were 5.5 years with high profits.

The figures illustrate again and again that the larger farms have the opportunity to make large incomes, but that they also run the risk of losing money when "things go wrong." Furthermore, not all farms experience the economic ups and downs in similar fashion.

Crop Yields Per Acre

When crop yields per acre increase, farm incomes have a tendency to do the same. The relationship is generally more apparent with a group of specialized farms on which the cash farm receipts are from the sale of corn and soybeans than with a group of diversified farms where some of the farm receipts are obtained from livestock or livestock products.

The relationship is particularly noticeable or strong during those years when the price of corn or soybeans is high or rising. Furthermore, when these prices are rising, the farm-to-farm variation in income increases, and the relationships between all other factors and incomes tend to strengthen.

Some crops vary more than others, of course, both in terms of yields per acre and the effect that those yields have on incomes. For example, corn yields respond more readily to the higher levels of fertilizer than do soybeans. As a result, the farm-to-farm variation in corn yields tends to be greater than the farm-to-farm variation in bean yields, at least percentagewise. And the greater the variation in yields per acre, the greater the effect on incomes (unless price movements predominate).

Trends in Crop Yields Several tables on corn and soybean yields per acre have been summarized here. Table 7 shows the trends for the last seven years.

Table 7. Trends in Crop Yields Per Acre.
Indiana Farm Accounts, 1976-1982.

Productivity Levels	Year						
	1976	1977	1978	1979	1980	1981	1982
	...Corn Yields Per Acre...						
Low	91	89	82	98	73	90	106
Below Average	112	102	102	114	98	112	126
Average	119	109	118	125	105	123	140
Above Average	130	117	128	139	117	130	151
High	145	136	145	156	136	143	168
All farms	120	110	115	126	106	120	138
	...Soybean Yields Per Acre...						
Low	21	30	23	31	32	24	34
Below Average	32	37	32	38	39	33	41
Average	38	41	38	41	42	37	44
Above Average	40	45	43	43	44	41	48
High	46	52	48	49	52	46	52
All farms	35	41	37	40	42	36	44

Except for the high yields in 1982, neither corn nor bean yields increased particularly over this seven-year period. There was considerable farm to farm variation each year. The average yields per acre and the percent of average for each of the five groups were as follows.

Farm Group	Corn Yield Per Acre	Percent of Average	Bean Yield Per Acre	Percent of Average
Bottom 20 percent	90	75	28	71
Next to bottom	109	91	36	92
Middle 20 percent	120	101	40	102
Next to top	130	109	43	109
Top 20 percent	147	123	49	125

The top farmers obtained yields from 10 to 25 percent above the average. (If one were to divide all farms into 10 groups and calculate the figures for the top 10 percent of all farms, their yields would probably be from 20 to 35 percent above the average of all farms.)

Relationships Between Crop Yields and Incomes, 1982 Table 8 shows the relationships between crop yields and incomes that existed in 1982. The relationships were quite strong for both corn and soybeans. As yields per acre increased, incomes increased.

Table 8. The Relationship Between Crop Yields and Labor Incomes. 65 Cash-Grain Farms, Indiana Farm Accounts, 1982.

Corn Yield Per Acre Range	Corn Yield Per Acre Average	Number of Farms	Acres of Cropland	Percent of Land in Corn	Land Value Per Acre	Labor Income
87 - 120	106	13	763	45	$1,501	$-13,808
121 - 130	126	13	882	49	1,544	-3,345
131 - 147	140	13	872	55	1,818	12,014
148 - 155	151	13	925	53	1,750	24,062
155 - 189	168	13	1,045	57	$1,993	$77,961
All farms	138	65	897	52	$1,709	$19,377

Soybean Yield Per Acre Range	Soybean Yield Per Acre Average	Number of Farms	Acres of Cropland	Percent of Land in Beans	Land Value Per Acre	Labor Income
27 - 38	34	13	812	43	$1,414	$-11,528
38 - 43	41	12	894	40	1,834	-18,370
43 - 46	44	13	740	38	1,805	18,741
46 - 49	48	12	1,022	34	1,857	51,924
50 - 56	52	13	1,094	40	$1,726	$58,109
All farms	44	63	911	39	$1,723	$19,870

* Only 63 farms raised soybeans.

Previous Year Comparisons. The relationships between corn and soybean yields and incomes held true for all seven years (Table 9). Even 1981 substantiated the relationship, although in a slightly different fashion. As crop yields increased in 1981, farm losses declined.

Table 9. Crop Yields Related to Labor Incomes. Indiana Farm Accounts, 1976-1982.

Level of Productivity	Labor Income Year 1976	1977	1978	1979	1980	1981	1982
	...Corn Yields Per Acre...						
Low	$ 2,326	$ 6,810	$-27,063	$-5,384	$ 9,220	$-60,533	$-13,808
Below Average	23,578	-17,631	29,568	12,730	29,262	-45,809	-3,345
Average	21,889	-21,947	11,035	55,563	49,811	-31,885	12,014
Above Average	50,730	16,107	42,427	41,517	52,012	-21,236	24,062
High	34,025	32,531	61,810	132,307	66,329	7,426	77,961
All farms	$26,669	$ 2,476	$24,228	$47,575	$41,351	$-30,428	$19,377

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Table 9. Crop Yields Related to Incomes, cont.

Level of Productivity	Labor Income Year 1976	1977	1978	1979	1980	1981	1982
	...Soybean Yields Per Acre...						
Low	$39,241	$ 5,387	$-13,065	$-1,064	$19,791	$-67,271	$-11,528
Below Average	27,228	-619	20,294	7,765	34,010	-35,493	-18,370
Average	21,711	6,914	19,444	34,300	38,686	-28,393	18,741
Above Average	28,088	-6,634	28,904	75,445	42,955	-13,379	51,924
High	44,619	13,282	65,721	123,384	82,810	- 550	58,109
All farms	$32,570	$ 3,210	$24,260	$48,352	$43,553	$-29,008	$19,870

Farms in the top 20 percent, both corn and soybean yields per acre, had incomes that were considerably above the average of all farms.

	Income Per Farm		Percent
	Average Farms	Farms in Top 20 Percent	of Average
Corn	$18,750	$58,913	314
Soybeans	20,401	55,339	271

Labor Efficiency

Labor efficiency may be measured in terms of acres of crops per man, numbers of livestock per man, total farm production per man, or productive man work units per man. The last criterion, work units per man, is undoubtedly the best.[4]

Relationship Between Efficiency and Incomes, 1982 As a farm family's efficiency increases, their income tends to increase. This relationship was somewhat erratic in 1982 (Table 10).

4 Total productive man work units, a measure of size, is divided by man equivalent to obtain man work units per man, a measure of efficiency.

Table 10. Relationship Between Man Work Units Per Man And Labor Incomes. 65 Farms, Indiana Farm Account Project, 1982.

Work Units Per Man Range	Work Units Per Man Average	Number of Farms	Acres of Cropland	Total Man Work Units	Number of Men	Total Farm Capital*	Labor Income
151 - 184	167	13	516	254	1.55	$1,200,727	$-2,833
185 - 202	195	13	717	370	1.88	1,648,058	16,554
203 - 259	226	13	718	368	1.58	1,491,615	2,886
260 - 287	274	13	1,390	667	2.42	3,290,624	56,053
290 - 450	345	13	1,146	638	1.89	2,335,742	24,224
All farms	242	65	897	459	1.87	$1,993,353	$19,377

Previous Year Comparisons Labor efficiency generally pays off, both during periods of rising prices and periods of falling prices. It is much more important when prices are declining.[5] The relationships, efficiency-to-income, were ascertained for the six years prior to 1982.

The relationship was particularly strong in 1978. In other years, there was a tendency for the expected relationship to be dominated by other factors (Table 11). However, the average income obtained by the top 20 percent of all farms, in terms of work units per man, was over twice the average income for all farms.

Table 11. Man Work Units Per Man Related to Labor Incomes. Indiana Farm Accounts, 1976-1982.

Efficiency as Measured By Units Per Man	Labor Income Year 1976	1977	1978	1979	1980	1981	1982
Low Efficiency	$53,143	$13,988	$-4,052	$ 4,401	$32,324	$-29,894	$-2,833
Below Average	16,788	17,674	-2,458	93,921	35,427	-14,723	16,554
Average	27,338	12,204	22,550	65,946	38,782	-67,006	2,886
Above Average	21,923	4,117	23,491	28,441	51,507	-27,376	56,053
High Efficiency	14,264	-36,991	85,526	38,210	49,067	-10,529	24,224
All farms	$26,669	$ 2,476	$24,228	$46,994	$41,351	$-30,428	$19,377

5 When farm prices are rising, one can increase size and perhaps ignore efficiency and incomes will tend to rise. However, when farm prices are falling, one needs to decrease the costs and emphasize every possible method of increasing efficiency.

Summary and Conclusions

Large numbers of commercial farms continue to operate, most with "satisfactory" farm incomes. The average farm continues to accept a fairly low rate of return on the capital it has invested in agriculture and a low rate of return on its labor and management. However, the top group, the top 20 percent of all commercial farms, obtain incomes far above those obtained by the average.

The farm-to-farm variation in the dollar returns between the small and the large, the inefficient and efficient, and unskillfully and skillfully managed farms is greater than most persons realize. That 20 percent of the farms are doing a job equal to the other 80 percent is obvious. The 80-20 split distinguishes those farmers with average goals and levels of management, who are satisfied with the so-called "good-life income," from the highly motivated entrepreneurs with the higher levels of management, who can't resist the challenge of farming both bigger and better.

The Indiana farm family is now operating in a level and perhaps declining agricultural economic environment. The margins between farm prices received and those that have to be paid have not improved to any extent in the last decade. Interest rates, which establish a hypothetical opportunity cost for much of the capital invested in agriculture, are now at the 10 to 12 percent level. Furthermore, the values placed on agricultural resources--land, labor, and capital--appear likely to continue to rise. As a result, more and more farm families are facing a financial squeeze.

For many farm families the most important yet difficult decisions pertain to the levels at which they plan to operate. Expansion and efficiency goals vary greatly. The Indiana Farm Accounts Project, from 1976 through 1982, has provided the data for the following figures. However, the question of whether they apply to any given farm is a matter of judgment. For some farms, the following goals are too restrictive; for others, the figures may be too big.

Goals Per Farm Management Level	Cash Grain Farms	
	Average	High
Total farm acres	1,250	2,750
Acres of cropland	1,160	2,500
Number of men	2.0	4.0
Farm capital ($1,000)[6]	$ 2,500	5,000
Corn yields per acre	135	155
Bean yields per acre	45	55

Whatever the individual farm family's goals, farm size continues to be the dominant factor in any study of the major factors affecting farm incomes. It matters not how size or volume is measured, total farm acres, acres of cropland, number of cows, number of hogs, number

6 Not based on purchase or replacement cost but "average" investments.

of men, total productive man work units, or total farm capital. As farm size or volume increases, the dollar returns to the farm family increase.

There is some year-to-year variation in each of the relationships, primarily because of the changing farm prices received by farmers and farm costs. When the price-cost relationship is unfavorable, the typical relationships between farm size and incomes sometimes reverse, with the larger farms encountering larger dollar losses than the small farms. This is not unexpected.

There also continues to be a strong relationship between crop yields and farm incomes, between milk sold per cow and farm incomes, between pigs raised per litter and farm incomes, and between farm efficiency and farm incomes. Again there is considerable variation in the year-to-year relationships depending on the relative favorableness of at least one other factor, the prices received for whatever farm product is being sold.

The empirical evidence indicates that it continues to pay most farmers to be large, to strive for high yields per acre and high rates of livestock production, and to be as efficient as possible in operating the Indiana farm business.

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